NDE of Microelectronic Packaging by Real Time X-ray Imaging

Real time X-ray has been demonstrated as an effective nondestructive evaluation (NDE) tool for microelectronic components and assemblies. Overview of a high-magnification, microfocus real-time x-ray system at JPL is presented and illustrated. This system is specifically designed with large field-of-view, ideal for overall viewing of entire microelectronic package.

The acquisition of x-ray in real-time eliminates the trial and error method as compared to conventional film x-ray method. Instead of film, and image intensifier is used to capture and convert x-ray to a viewable video signal via CCD camera. This technique eliminates repeat parts exposure, film development, x-ray and part position adjustment.

The x-ray source used at JPL NDE laboratory is of a point source type about 4 microns in focal spot size. This is done by focus the electron beams to a very small spot on the tungsten target. Because x-ray is emitted from a point source, a well-defined conical pattern is resulted with geometric sharpness, which is critical in detecting small anomalies in microelectronic packages. In addition, geometric magnification is achieved in real time, where the image is project into the image intensifier by the "shadowgraph" principal.

By changing the distance between microfocus x-ray point source and the part and vary the position of image intensifier, magnification of up to 1000x can be achieved with very low distortion and a final output resolution of 2.5 lp/mm (line pairs per millimeter).

Benefits and limitations with various types of microelectronic packages will be discussed based on inspectability.

Brief Bio:

David Mih is a Senior Member of Engineering Staff at JPL, responsible for the NDE (Non Destructive Evaluation) laboratory research and technology programs under Quality Assurance Office. His primary efforts are to develop applications of advanced NDE methods for inspection and quantitative analyses of microelectronic devices.

He received MSEE from University of Southern California and BSEE from North Carolina State University. He has over 10 years of NDE experiences and two patents related to advanced quality assurance technologies.